



NAESS & MURPHY · ARCHITECTS · ENGINEERS

August 30, 1960

Mr. George L. DeMent
Commissioner of Public Works
City Hall
Chicago 2, Illinois

Dear Commissioner DeMent:

Chicago-O'Hare International Airport
First Stage Development Program
Interim Report

In accordance with your recent request, we submit herewith a report analyzing construction costs for the O'Hare Revenue Bond First Stage Development Program. The report sets forth construction costs to date and projects fund requirements for the balance of the authorized program.

Since March 1959, when revenue bond funds became available and final engineering was authorized, twenty-four separate construction projects have been engineered for bidding. Twenty-three of these projects have been bid and nineteen are under construction. One more is currently in process of bidding.

Construction contracts have been awarded for nineteen projects for an aggregate amount of \$47,978,752. These divide as follows:

General Construction Account	\$33,678,172.
Hangar Construction Account	<u>14,300,580.</u>
	\$47,978,752.

From experience during the first half of the program it is certain that the original estimate of funds for the General Construction Account will be exceeded. Reasons for overrun in costs are detailed in Section II of this report. For the most part they are the result of working out detailed design problems in developing the engineering and construction phases of the work and did not arise from basic changes in the scope of the program. Costs were also increased over estimates because of conditions, impossible to anticipate, encountered as the work progressed; and in several cases early estimates proved to be inadequate due to the fact that preliminary drawings could not be developed in sufficient detail beforehand.

We now estimate that approximately \$35,000,000 will be needed to complete the first stage program. This includes a new contingency reserve of approximately \$3,000,000 on the first stage program, but does not take into account any deduction for interest reserves which are accruing on the proceeds of the initial bond issue.

We believe that it is impossible to cut back the program since a lesser program will not fulfill the requirements. In fact, as traffic estimates for the airport are currently being exceeded, we believe that the initial program should be extended to include additional facilities which will be needed in the immediate future. In accordance with your recent request, we have listed in Section III of the report several new projects that are recommended for early construction.

Our preliminary estimates indicate that \$26,239,000 will be needed for this new construction. Due to the preliminary nature of these estimates a 10% contingency reserve has been allowed in this cost.

If these projects are included in the first stage of construction a total of \$60,889,000 additional funds will then be necessary to complete the program.

Yours very truly,

NAESS & MURPHY

Carter H. Manney Jr.

INTERIM REPORT

- I Comparison of Actual Costs and Future Projections with Original Estimate
- II Analysis of Differences Between Original Estimates and Present Projections
- III Additional Projects Recommended for Construction
- IV Contract Awards to Date
- V Contract Schedules
- VI Value of Revenue Bond Contracts

August, 1960

COMPARISON OF ACTUAL COSTS AND FUTURE PROJECTIONS WITH ORIGINAL ESTIMATE

	1. Original Estimate	2. Actual Cost to Date	3. Est. Bal. of Costs	4. Total (Cols. 2 & 3)	5. Under	6. Over
A. RUNWAYS AND TAXIWAYS						
1. Taxiways Serving Cargo Area	\$ 986,000	\$ 139,000	\$ 889,000	\$ 1,028,000		\$ 42,000
2. Improvements to Runway 14R-32L	333,000	390,000		390,000		57,000
3. Taxiway to Hangar Area	1,492,000	1,174,000	390,000	1,564,000		72,000
4. Outer Circular Taxiway	1,467,000	1,328,000	408,000	1,736,000		269,000
5. Taxiway Shoulder Stabilization	267,000		201,000	201,000	\$ 66,000	
6. Blast Fence	7,000		7,000			
B. UTILITIES						
1. Water Main to Terminal Area	\$1,840,000	\$ 433,000	\$1,306,000	\$1,739,000	101,000	
2. Water Main to Hangar Area	596,000	475,000	24,000	499,000	97,000	
3. Terminal Area Water Reservoir	711,000		660,000	660,000	51,000	
4. Sanitary Sewer to Hangar Area	605,000	635,000	274,000	909,000		304,000
5. Airport Storm Drainage Improvements	942,000	1,636,000	1,738,000	3,374,000		2,432,000
6. Cargo Area Utilities	208,000		195,000	195,000		
7. New Heating & Refrigeration Plant	4,530,000	929,000	6,586,000	7,515,000		2,985,000
8. Fueling System	5,413,000	2,403,000	4,893,000	7,296,000		1,883,000
C. TERMINAL AREA						
1. New Terminal Bldgs., Concourses & Restaurants	\$23,500,000	\$13,585,000	\$18,859,000	\$32,444,000		\$8,944,000
2. New Apron Paving	9,014,000	1,245,000	8,644,000	9,889,000		875,000
3. Main Entrance Roadway	1,166,000	2,008,000	4,408,000	6,416,000		5,250,000
4. Parking Lot	1,610,000	733,000	2,246,000	2,979,000		1,369,000
5. Landscaping	500,000	18,000	482,000	500,000		
6. Apron Paving Split Finger B	410,000	501,000		501,000		91,000
7. Alterations to Terminal B & Concourse	1,520,000			5,550,000		4,030,000

	1. Original Estimate	2. Actual Cost to Date	3. Est. Bal. of Costs	4. Total (Cols. 2 & 3)	5. Under Over	6.
D. HANGAR AREA						
1. Railroad Connection	\$ 14,000	\$ 19,000		\$ 19,000		\$ 5,000
2. Overall Grading	554,000	880,000		880,000		326,000
3. Balance of Hangar Roads	372,000	627,000	\$ 100,000	727,000		355,000
E. CARGO AREA						
1. Airplane Parking Apron	1,035,000	224,000	756,000	980,000	\$ 55,000	
2. Roads and Truck Parking	217,000	75,000	468,000	543,000		326,000
3. Cargo Warehouses	1,001,000		1,528,000	1,528,000		527,000
F. SERVICE AREA						
1. Fire Station	330,000		513,000	513,000		183,000
2. Airport Maintenance Building	353,000	19,000	449,000	468,000		115,000
G. REQUIRED ADDITIONAL ITEMS						
1. Additional Roadways	164,000		301,000	465,000		465,000
2. Temporary Taxiways	21,000			21,000		21,000
3. Overall Airport Grading	2,377,000			2,377,000		2,377,000
4. Reshape Outfall Ditch			145,000	145,000		145,000
5. Conversion of Existing Reservoir			175,000	175,000		175,000
6. Revision to Control Tower Heating Sys.			35,000	35,000		35,000
7. Underground Electrical Manholes & Duct Distribution System	1,434,000			1,434,000		1,434,000
8. Misc. Other Electrical Work			236,000	236,000		236,000
9. Relocation of Temporary International Bldg.	164,000			164,000		164,000
10. Airport Construction Clean up	27,000			27,000		27,000
11. Temporary Measures to Facilitate Airport Operations			200,000	216,000		216,000
12. Expanded Weather Station			91,000	91,000		91,000
TOTALS	\$60,993,000	\$33,678,000	\$62,758,000	\$96,436,000		\$35,443,000

	1. Original Estimate	2. Actual Cost to Date	3. Est. Bal. of Costs	4. Total (Cols. 2 & 3)	5. Under Over	6.
Performance Bond @ 1%	\$ 609,000			\$ 609,000		
Architect's Fee - Preliminary Work	350,000	\$ 681,000		\$ 681,000		\$ 331,000
Working Drawings and Supervision @ 5-1/2%	3,388,000	1,852,000	\$ 3,452,000	5,304,000		1,916,000
Surveying & Material Testing Estimated @ 1%		337,000	628,000	965,000		965,000
Contingency @ 10%	6,534,000		3,138,000*	3,138,000*	3,396,000	
SUB-TOTALS, FIRST STAGE PROGRAM	\$ 71,874,000	\$36,548,000	\$69,976,000	\$106,524,000		\$34,650,000
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RECOMMENDED ADDITIONAL ITEMS						
1. Electronic Arrival-Departure Board		Preliminary Estimate <u>1,400,000</u>		1,400,000		1,400,000
2. Elevated Parking Deck	3,300,000		3,300,000		3,300,000	
3. Additional Air Cargo Facilities	4,075,000		4,075,000		4,075,000	
4. Runway 9R-27L	10,000,000		10,000,000		10,000,000	
5. New Control Tower	1,000,000		1,000,000		1,000,000	
6. Taxiway over Entrance Road	<u>2,750,000</u>		<u>2,750,000</u>		<u>2,750,000</u>	
TOTALS	22,525,000				22,525,000	22,525,000
Working Drawings & Supervision @ 5-1/2%	1,239,000		1,239,000		1,239,000	

* Computed at 5% based on 50% completion.

1. Preliminary Estimates	2. Actual Cost to Date	3. Est. Bal. of Costs	4. Total (Cols. 2 & 3)	5. Under	6. Over
Surveying & Material Testing Estimated @ 1%	\$ 225,000	\$ 225,000	\$ 225,000	\$ 225,000	\$ 225,000
Contingency @ 10%	2,250,000	2,250,000	2,250,000	2,250,000	2,250,000
SUB-TOTALS ADDITIONAL WORK	26,239,000	26,239,000	26,239,000	26,239,000	26,239,000
GRAND TOTALS	96,215,000	132,763,000	60,889,000		

CHICAGO-O'HARE

VALUE OF REVENUE BOND

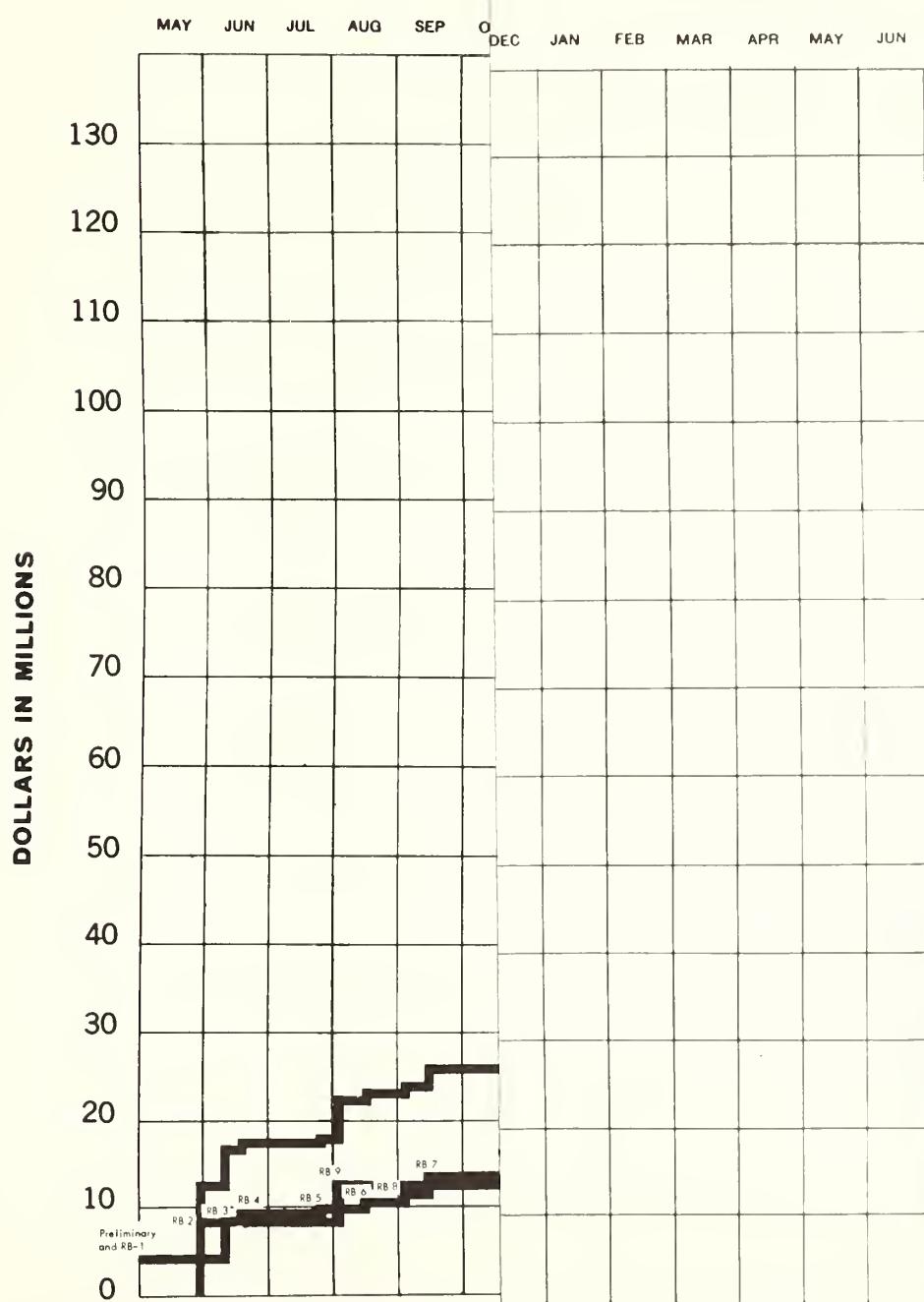
■ HANGAR

■ GENERAL

■ TOTAL

1959

1962



CHICAGO-O'HARE INTERNATIONAL AIRPORT

VALUE OF REVENUE BOND CONTRACTS

KEY:

HANGAR
GENERAL
TOTAL

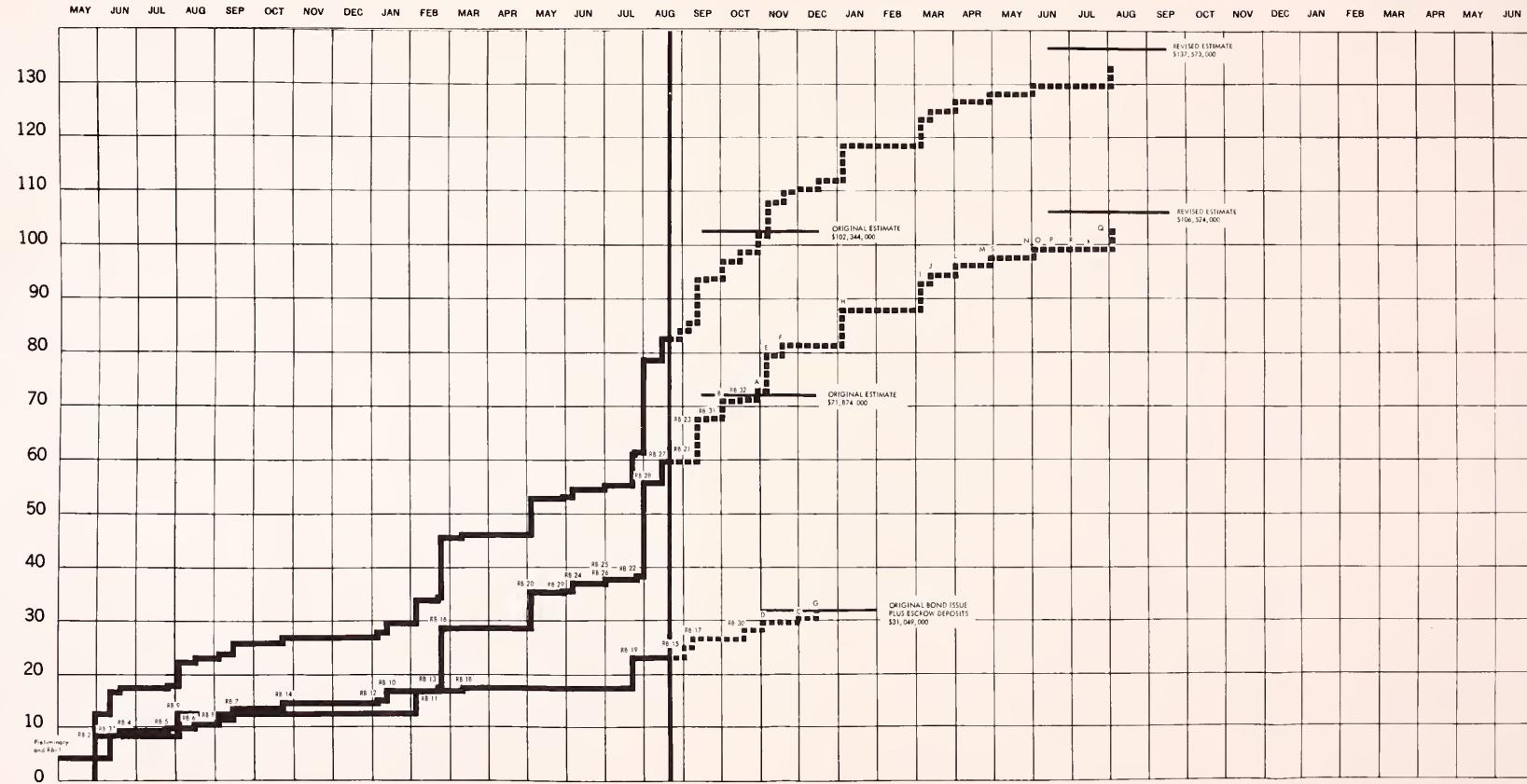
1959

1960

1961

1962

DOLLARS IN MILLIONS



CHICAGO-O'HARE

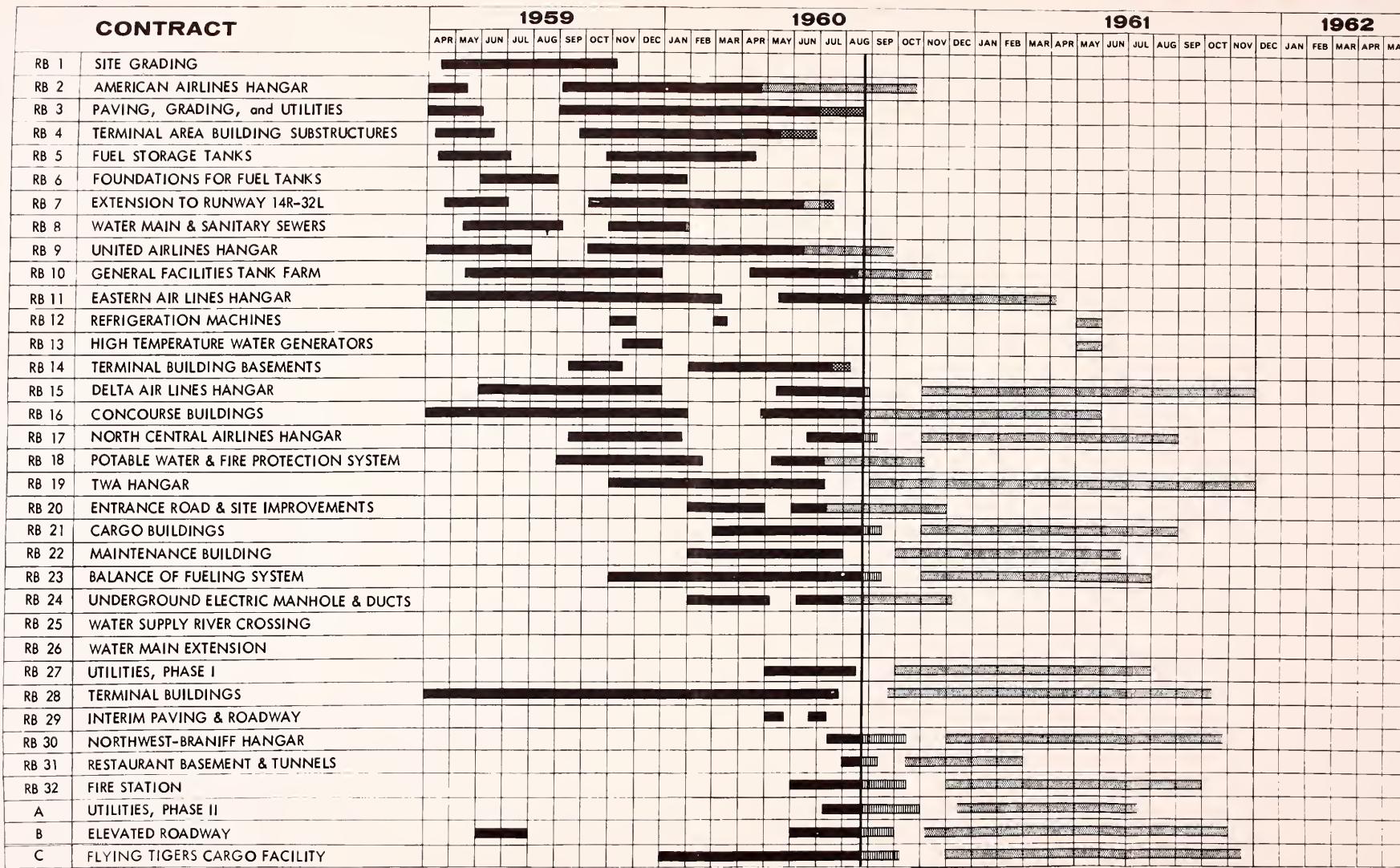
CONTRACT SCHEDULES

- SCHEDULED ENGINEERING
- AUTHORIZED EXTENSION
- SCHEDULED CONSTRUCTION
- ACTUAL PERFORMANCE

CHICAGO-O'HARE INTERNATIONAL AIRPORT

CONTRACT SCHEDULES

 SCHEDULED ENGINEERING
 AUTHORIZED EXTENSION
 SCHEDULED CONSTRUCTION
 ACTUAL PERFORMANCE
KEY:



CHICAGO-O'HARE CONTRACT SCHEDULES

SCHEDULED ENGINEERING

SCHEDULED CONSTRUCTION

AUTHORIZED EXTENSION

ACTUAL PERFORMANCE

CHICAGO-O'HARE INTERNATIONAL AIRPORT

CONTRACT SCHEDULES

KEY:

- SCHEDULED ENGINEERING
- SCHEDULED CONSTRUCTION
- AUTHORIZED EXTENSION
- ACTUAL PERFORMANCE

II. ANALYSIS OF DIFFERENCES BETWEEN ORIGINAL COST ESTIMATES AND CURRENT PROJECTIONS

A. RUNWAYS AND TAXIWAYS

1. Taxiways Serving Cargo Area

Original Estimate	\$ 986,000
Actual Cost to Date	\$ 139,000
Estimated Balance of Costs	<u>889,000</u> 1,028,000
Overage	\$ 42,000

The overage on this item resulted from the addition of short turn-offs to the future parallel taxiway to 9R-27L. It was deemed necessary that these short turn-offs be added in the first stage program in order to prevent any interruption of service to the Cargo Area when Runway 9R-27L and its parallel taxiway are constructed later.

2. Improvements to Runway 14R-32L

Original Estimate	\$ 333,000
Actual Cost to date	<u>390,000</u>
Overage	\$ 57,000

The overage on this item resulted from a change in final engineering design which required a large box culvert in lieu of a multiple pipe system as part of the program to eliminate the hazardous ditch at the end of the runway. Also very poor soil conditions were encountered in constructing the box culvert which necessitated increased yardages of suitable material.

3. Taxiway to Hangar Area

Original Estimate	\$1,492,000
Actual Cost to Date	\$1,174,000
Estimated Balance of Costs	<u>390,000</u> 1,564,000
Overage	\$ 72,000

An overage on this item is anticipated because of the addition of taxiway lighting to the property lines of each hangar lot. Although, the taxiway connections to each hangar lot are provided by the airlines under each hangar contract, the lighting for these connections must be part of the overall airport system. Prudent engineering design dictated that this lighting be added to the general construction program.

4. Outer Circular Taxiway

Original Estimate	\$1,467,000
Actual Cost to Date	\$1,328,000
Estimated Balance of Costs	<u>408,000</u> 1,736,000
Overage	\$ 269,000

There was some saving on this item because of federal participation on Contract RB-7, however, there is still a net overage above the original estimate. This overage resulted from the extension of the outer circular taxiway around Concourse Building #9. In the final engineering design it was deemed essential to add this taxiway, which is part of the ultimate master plan, in order to permit two-way aircraft traffic from this concourse in the same manner as is being provided for all other concourses.

5. Taxiway Shoulder Stabilization

Original Estimate	\$ 267,000
Estimated Balance of Costs	<u>201,000</u>
Underage	\$ 66,000

The anticipated underage on this item resulted from a current forecast of lower unit prices for this work than originally estimated.

6. Blast Fence

Original Estimate	\$ 7,000
Estimated Balance of Costs	<u>7,000</u>

No change in this estimate.

B. UTILITIES

1. Water Main to Terminal Area

Original Estimate	\$1,840,000
Actual Cost to Date	\$ 433,000
Estimated Balance of Costs	<u>1,306,000</u>
Underage	\$ 101,000

The anticipated savings on this item are due to a favorable construction arrangement with the City Water Department and to lower unit prices for materials than originally estimated.

2. Water Main to Hangar Area

Original Estimate	\$ 596,000
Actual Cost to Date	\$ 475,000
Estimated Balance of Costs	<u>24,000</u>
Underage	\$ 97,000

The savings now anticipated on this item are due to favorable prices actually received on Contract RB-8. These savings would have been even larger had not winter construction and increased airport operations dictated tunnelling under several taxiways originally planned for open cutting.

<u>3. Terminal Area Water Reservoir</u>		
Original Estimate		\$ 711,000
Estimated Balance of Costs		660,000
Underage		\$ 51,000

The underage now anticipated on this item is due to later engineering design which contemplates a savings over the original estimate in pumping equipment and meters.

<u>4. Sanitary Sewer to Hangar Area</u>		
Original Estimate		\$ 605,000
Actual Cost to Date	\$ 635,000	
Estimated Balance of Costs	274,000	909,000
Overage		\$ 304,000

The overage on this item resulted from closer spacing of manholes requested by City Bureau of Sewers and unforeseen improvements necessary to the existing sewer in the Terminal Area.

<u>5. Airport Storm Drainage</u>		
Original Estimate		\$ 942,000
Actual Cost to Date	\$ 1,636,000	
Estimated Balance of Costs	1,738,000	3,374,000
Overage		\$ 2,432,000

There are several factors which have contributed to the large overage on this item. During the course of detailed engineering of the airport utility systems (gas, electricity, water sanitary and storm), it became evident that the high outfall elevation of the area drainage to the Des Plaines River would not permit the extensive use of open ditches for storm drainage in areas where it was necessary to cross the ditches with other utilities. To effect these crossovers it was essential to carry the storm drainage in pipe much more extensively than originally contemplated.

Also the apparent imminence of construction of future runway 9R-27L made it advisable to extend the pipe system beyond the location of this runway at this time.

Other factors which contributed to the original estimates being exceeded were City requirements to increase capacities and use less corrugated metal pipe and more concrete pipe than originally planned.

Also final engineering design made it necessary to introduce two large lift stations to serve the underpass into the main parking lot and a depression created in the entrance roadway which will accommodate a future overpass for a taxiway connection between runways 27L and 27C.

6. Cargo Area Utilities

Original Estimate	\$ 208,000
Estimated Balance of Costs	195,000
Underage	\$ 13,000

A more finalized engineering design at this time indicates that the original estimate was more than adequate.

7. New Heating and Refrigeration Plant

Original Estimate	\$4,530,000
Actual Cost to Date	\$ 929,000
Estimated Balance of Costs	6,586,000
Overage	\$2,985,000

Later engineering design indicated that the heating and cooling distribution system, which is included under this item, should be greatly expanded over preliminary estimates. Pipe sizes were increased and, whereas originally a two pipe distribution system seemed adequate it later appeared essential to have a three pipe system for both chilled water and high temperature water in order to offer maintenance flexibility which will avoid shut downs of service to large areas of the Terminal Buildings during times of repair. In addition, we propose adding a centralized control system not originally contemplated. Although this is an added capital cost we believe that it will more than pay for itself in future operational and maintenance savings.

In addition, air conditioning requirements are considerably greater than anticipated, particularly in the airline areas on the first floor of the concourses.

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Not only have pipes been increased in number but also in size. This has required greatly expanding the underground tunnels at a considerable increase in cost.

The heating and refrigeration building has also increased in size resulting in some increase over original estimates.

On the other hand, contract prices for the high temperature hot water generators and the refrigeration compressors under Contracts RB-12 and RB-13 were considerably below original estimates.

8. Fueling System

Original Estimate	\$5,413,000
Actual Cost to Date	\$2,403,000
Estimated Balance of Costs	<u>4,893,000</u>
Overage	<u>7,296,000</u> \$1,883,000

The large overage on this item has resulted from several factors. Among the most important are the following:

- a. Airline request to increase the number of bulk storage tanks to permit greater supply flexibility.
- b. Airline need during interim period for temporary truck fill stands in the main tank farm to permit early use of storage facility.
- c. Insurance company requirement for more extensive fire protection system in the tank farm than was originally contemplated.
- d. Safety considerations dictated burying satellite tanks completely below grade rather than mounding as originally planned.
- e. A large parking apron for refueler trucks was added in the permanent truck fill stand area.
- f. Later engineering developments indicate that changes in aircraft and airline furnished ramp equipment require modification of the fueling system for compatibility. (i.e. pressure drop of hydrant carts and aircraft require increased pumping head in fueling system.)

C. TERMINAL AREA

1. New Terminal Buildings, Concourses and Restaurants

Original Estimate	\$23,500,000
Actual Cost to Date	\$13,585,000
Estimated Balance of Costs	<u>18,859,000</u>
Overage	<u>32,444,000</u> \$ 8,944,000

This large overage is in two major areas. The mechanical - electrical work in the buildings has increased by approximately \$4,500,000 and the general work by approximately \$4,400,000. Much of the increase in the mechanical - electrical work can be explained by later developments, wherein it was found that airline requirements were much greater than originally anticipated (i.e. more air conditioned areas on the apron level of the concourses and great increases in electric power requirements at aircraft parking positions.) This factor also contributed to increases in the general work. The concourse utility tunnel, for instance, was expanded to nearly three times the width originally proposed. Penthouses which enclose the mechanical equipment were expanded considerably.

Efforts have been made during the course of design to effect economies wherever practical. The structure of the building was changed from steel to reinforced concrete at a substantial savings and the exterior walls on the lower level of the concourses were changed to concrete block. In other areas materials have generally remained as originally contemplated, but it is apparent that quantity take-offs from preliminary plans were inadequate and that unit prices estimated for some items were also inadequate.

2. New Apron Paving

Original Estimate	\$9,014,000
Actual Cost to Date	\$1,245,000
Estimated Balance of Costs	<u>8,644,000</u>
Overage	<u>9,889,000</u> \$ 875,000

Later engineering analysis indicates that a large section of the existing apron in the area of Concourse #3 is at the wrong elevation for proper drainage. Other areas along this concourse must also be removed and replaced to permit installation of the underground fueling system.

In addition, ground water conditions indicate that a sub-surface drainage system should be provided under all new aprons.

3. Main Entrance Road

Original Estimate	\$1,166,000
Actual Cost to Date	\$2,008,000
Estimated Balance of Costs	<u>4,408,000</u>
Overage	<u>6,416,000</u> \$5,250,000

The large overage on this item has resulted from several factors:

- a. Later planning and engineering considerations indicated that the volumes of automobile traffic anticipated demand a grade separation at the entrance into the parking lot. To design this separation without greatly reducing the area of the parking lot, it was necessary to shift the parking lot entrance to the north. This in turn required construction of additional length of new roadway and abandoning more of the existing roadway than previously planned.
- b. The road materials were changed from asphalt to concrete to conform with the connections to the Northwest Highway constructed by the County.
- c. The master plan for the future development of the airport calls for a taxiway connection between runways 9R-27L and 9C-27C on the east side of the terminal area. It is necessary for this taxiway to pass over the entrance road. In order to maintain access into the

- terminal area when the overpass is constructed in the future it was deemed advisable to depress the entrance roadway at this time.
- d. The unit price assigned to the elevated roadway structure in the original estimate was too low. Although the final design of this structure is an economical one, it will cost considerably in excess of the original estimated figure.
 - e. Later design considerations indicate the use of more curbs and gutters than originally planned.

4. Parking Lot

Original Estimate	\$ 1,610,000
Actual Cost to Date	\$ 733,000
Estimated Balance of Costs	<u>2,246,000</u>
Overage	\$1,369,000

Later engineering considerations indicate that there can be no salvage of the existing pavement. New pavement with adequate base is now estimated at a considerably higher unit cost than in the original estimate. Later engineering considerations indicate that the original estimate for electric lighting is also inadequate. In addition, some sidewalks and canopies have been added.

(At the time of this writing consideration is being given to double decking a portion of the parking lot (see Section III). This would probably change the paving materials to concrete under the deck).

5. Landscapeing

Original Estimate	\$ 500,000
Actual Cost to Date	\$ 18,000
Estimated Balance of Costs	<u>482,000</u>

There has been no change in the original plan to budget an arbitrary amount of \$500,000 for landscaping.

6. Apron Paving for Split Finger B

Original Estimate	\$ 410,000
Actual Cost to Date	<u>501,000</u>
Overage	\$ 91,000

The unit prices for this work exceeded those originally estimated. In addition an electrical grounding system was added to this project.

7. Alterations to Terminal B

Original Estimate	\$1,520,000
Estimated Balance of Costs	<u>5,550,000</u>
Overage	\$4,030,000

Original planning was based on a skeleton program. Due to an increased demonstrated traffic growth, Landrum and Brown, our Airport Consultants now advise that this facility should be planned to handle approximately 800,000 deplanned passengers annually, estimated between 1965 and 1970, with provision to extend the facility to handle potential ultimate traffic of approximately 1,500,000 deplanned passengers. These capacities require extensive remodelling of the existing building and the addition of an expandable section to the front of the existing building.

D. HANGAR AREA

1. Railroad Connection

Original Estimate	\$ 14,000
Actual Cost to Date	19,000
Overage	\$ 5,000

The contract price for this work exceeded the original estimate.

2. Overall Grading

Original Estimate	\$ 554,000
Actual Cost to Date	880,000
Overage	\$ 326,000

Poor soil conditions encountered in actual grading operations required removal and replacement of larger earth quantities than foreseen. Unit prices also exceeded original estimates.

3. Balance of Hangar Area Roads

Original Estimate	\$ 372,000
Actual Cost to Date	\$ 627,000
Estimated Balance of Costs	100,000
Overage	\$ 727,000
	\$ 355,000

Grading preparatory to roads was greater than anticipated because of poor soil conditions. Unit prices were higher for pavement and base than anticipated. Also extensive sub-surface drainage was required because of poor soil conditions.

E. CARGO AREA

1. Airplane Parking Apron

Original Estimate	\$ 1,035,000
Actual Cost to Date	\$ 224,000
Estimated Balance of Costs	756,000
Underage	\$ 980,000
	\$ 55,000

Although sub-surface drainage has been added in the later engineering designs, unit prices anticipated for the balance of the paving work are anticipated to result in a saving over the original estimate.

<u>2. Roads and Truck Parking</u>		
Original Estimate		\$ 217,000
Actual Cost to Date	\$ 75,000	
Estimated Balance of Costs	468,000	543,000
Overage		\$ 326,000

Unit prices are now expected to exceed the original estimate. Poor soil conditions resulted in increased excavation and soil preparation and necessitated french drains.

Extent of road has increased in service and in connection to Mannheim Road via Lawrence Avenue. (The County Highway Department has requested that there be no access to Mannheim Road between Lawrence Avenue and the airport Lead-in road).

3. Cargo Warehouses

Original Estimate	\$ 1,001,000
Estimated Balance of Costs	1,528,000
Overage	\$ 527,000

Original estimates were based on unit costs for existing cargo warehouse. New cargo warehouses, however, now must conform to Chicago Building Code which requires extensive mechanical ventilation which was not required at time original building was constructed in 1955.

Airlines have recommended a sprinkling system to reduce insurance risks. This is also an added item.

From study of operation of existing facility, it was found that additional toilets and an improved type heating system should be provided and that apron and truck parking lighting should be increased.

F. SERVICE AREA

1. Fire Station

Original Estimate	\$ 330,000
Estimated Balance of Costs	513,000
Overage	\$ 183,000

Original estimate contemplated two-story fire station which proved unsuitable in final design analysis. Final plans contemplate single story unit which has been expanded somewhat in accordance with Fire Department requests.

Site conditions require removal of large section of existing 15" concrete pavement. Both the removal of the existing concrete and the installation of new pavement was omitted from the original estimate.

2. Airport Maintenance Building

Original Estimate	\$ 353,000
Actual Cost to Date	\$ 19,000
Estimated Balance of Costs	449,000
Overage	\$ 115,000

The overage on this item has resulted principally from increased mechanical and electrical requirements in the final engineering design. In addition, it is now anticipated that the unit cost for exterior paving will be substantially exceeded. Also because of soil conditions grading costs have been exceeded and french drains have had to be added to the pavement design.

G. REQUIRED ADDITIONAL ITEMS

1. Additional Roadways

Actual Cost to Date	\$ 164,000
Estimated Balance of Costs	301,000
	\$ 465,000

During the course of actual construction and later engineering design, it has been found essential to construct several temporary roads to facilitate construction and lessen interference with airport operations. One of these service roads has been designed to conform to a road master planned for future construction around the terminal area apron. It will thus remain as a part of the permanent roadway system.

2. Temporary Taxiway

Actual Cost	\$ 21,000
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It was necessary to add this item as a temporary measure when existing access to the temporary maintenance area was removed to make way for construction of concourse #5.

3. Overall Airport Grading

Actual Cost to Date	\$2,377,000
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Later engineering design indicated that it was necessary to grade and shape more areas of the airport than originally planned. Soil conditions at O'Hare are much worse than were originally foreseen. It has been necessary to excavate and replace much more unsuitable material than was anticipated in order to obtain a proper base for any future work.

4. Reshape Outfall Ditch
Estimated Cost \$ 145,000

Present indications are that it will be necessary to clean, deepen and reshape existing outfall ditches serving the airport in order to accommodate future drainage requirements.

5. Conversion of Existing Reservoir
Estimated Cost \$ 175,000

Insurance advisors and the Fire Prevention Bureau has requested conversion of existing reservoir for increased fire protection. This will require installation of new pumps, piping and electric wiring.

6. Revision to Control Tower Heating System
Estimated Cost \$ 35,000

It is planned that the existing control tower will remain in the first stage of construction. The present steam heating system will require modification for operation for the new hot water system.

7. Underground Electrical Manholes and Duct Distribution System
Actual Cost to Date \$1,434,000

Original plans contemplated use of direct burial cables except under paved areas where ducts were planned. Later engineering indicated that a direct burial distribution system was inadvisable and would be more costly and troublesome in future airport operations than if electrical distribution cables were contained in ducts. Accidental cutting of existing direct burial cables has been a serious source of annoyance to airport operations during the construction program to date.

8. Miscellaneous Other Electrical Work
Estimated Costs \$ 236,000

During the construction, it has been found that temporary power connections will be necessary to facilitate airport operations.

Since preliminary estimates power requirements have greatly increased. To supply proper capacities to various facilities, it will be necessary to provide secondary switchgear equipment at the Commonwealth Edison's substation not originally contemplated.

It is also planned to provide ducts for a fire alarm system in the terminal area requested by the Bureau of Fire Prevention.

9. Relocation of Temporary International Building

Cost to Date	\$ 164,000
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To allow construction of the new terminals, it was necessary to relocate the existing International Building. At the new location it was necessary to expand the aircraft apron and provide a temporary parking lot and roadway to allow efficient operation of this facility.

10. Airport Construction Clean Up

Estimated Balance of Cost	\$ 27,000
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Construction has required heavy equipment and trucks to travel on and across taxiways and runways. It has been necessary to have special cleaning equipment "on call" at all times to remove the resultant debris which could cause great damage to jet aircraft.

11. Temporary Measures to Facilitate Airport Operations

Cost to Date	\$ 16,000
Estimated Balance of Costs	200,000
Total	\$ 216,000

As airport operations have greatly increased it will be necessary to provide temporary utility and power connections to allow uninterrupted service during the interim until new facilities are completed. It is envisioned that barricades around Terminal Area construction will be necessary and that other temporary parking areas and walks will be necessary to properly handle increased numbers of airport users.

12. Expanded Weather Station

Estimated Balance of Costs	\$ 91,000
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To provide necessary weather information for the forecasted volumes of traffic, it has been found that present weather station must be expanded.

III ADDITIONAL PROJECTS RECOMMENDED FOR CONSTRUCTION

1. Electronic System for Arrival and Departure Boards

The original program contemplated the use of airline furnished, manually posted arrival and departure boards. We now believe that this is not the best solution to the problem. After an exhaustive study with the airlines and equipment manufacturers, we recommend a system using four large electronically posted boards in each of the two domestic terminal buildings. A third system probably requiring fewer boards is recommended for the International Terminal.

This system has been described and presented to you and the airlines in a previous report.

Preliminary estimate of cost excluding International Building \$ 1,400,000

2. Elevated Parking Deck

The original program contemplated only grade level parking in the first stage. As described to you in a recent brief report, we now feel that parking will be inadequate in 1965 and recommend the construction of approximately one half of a proposed future parking deck at this time.

Preliminary Estimate of Cost \$ 3,300,000

3. Additional Air Cargo Facilities

During the past year several airlines have indicated that their original forecasts for air cargo facilities were far short of their present predictions. United, American, NOR and Delta have already requested that means be found for providing additional facilities. Several freight forwarders have also expressed an interest in obtaining facilities at O'Hare as have a few of the international carriers and U. S. Customs.

This problem is currently being pursued by an Airlines Cargo Subcommitte and by the Department of Aviation.

We estimate that approximately 150,000 square feet in additional cargo buildings with accompanying aprons, taxiways and roads will be required to provide the necessary facilities.

Cargo warehouses	\$2,225,000
Aircraft Apron	1,000,000
Taxiways	500,000
Truck Parking	<u>350,000</u>
TOTAL	\$4,075,000

4. Runway 9R-27L

Construction of this runway was deleted from the first stage program in order to reduce initial capital expenditures. Expanding traffic at O'Hare indicates that this runway will be needed at the completion of the First Stage Program.

Preliminary Cost Estimate \$ 10,000,000

5. New Control Tower

The present control tower is too low to permit an unobstructed view of all runways and taxiways. A future higher and larger tower is master planned near the center of the terminal complex. It would provide greater space for FAA and City offices and would be constructed so as to provide support for the new Air Surface Detection Radar facility which the Federal Aviation Agency has already programmed for installation at O'Hare.

\$ 1,000,000

6. Taxiway Over Entrance Road

At present taxiway distances to the instrument runway, 14L 32R, and the present east-west runway do not allow efficient and economical aircraft movements. It is proposed to extend the outer circular taxiway around the terminal area over the Entrance Road to effectively reduce taxi distances to these very active runways.

\$ 2,750,000

IV

CONTRACT AWARDS TO DATE

The following is a list of construction contracts awarded to date of this report.

<u>Contract No.</u>	<u>Description</u>	<u>Amount of Original Contract & Change Orders</u>
RB-1	Site Grading, Phase 1	\$ 2,442,589
RB-2	American Airlines Hangar	5,387,000
RB-3	Paving, Grading & Utilities	4,071,388
RB-4	Terminal Building Substructures	1,625,562
RB-5	Sixteen Fuel Tanks	474,920
RB-6	Foundations for Fuel Tanks	88,570
RB-7	Second Extension to Runway 14R-32L and Portion of Outer Circular Taxiway (Revenue Bond Portion only)	1,841,505
RB-8	Water Main & Sanitary Sewers	1,256,213
RB-9	United Air Lines Hangar	4,652,914
RB-10	General Facilities Tank Farm	1,645,000
RB-11	Eastern Air Lines Hangar	3,794,000
RB-12	Refrigeration Equipment	283,477
RB-13	High Temperature Water Generators	218,926
RB-14	Terminal Building Basements	818,690
RB-16	Concourse Buildings Superstructure	11,097,000
RB-18	Hangar Reservoir (EAL, CAP, NWA-BNF)	466,666
RB-20	Site Grading Phase II and Entrance Road Paving	5,986,734
RB-24	Underground Electric Manholes and Ducts (Revenue Bond Portion only)	1,792,637
RB-29	Interim Paving and Alterations to Parking Lot	34,961
	Total Under Contract	\$47,978,752



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